Distributions of leafmining sawflies (Hymenoptera: Tenthredinidae) on birch and alder in northwestern Canada

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Exotic leafmining sawflies (Hymenoptera: Tenthredinidae) on birch (*Betula* spp., Betulaceae) have become widely distributed in Canada since their introduction to eastern North America in the last century (Digweed *et al.* 1997). However, their distributions north of the 60th parallel are poorly known (Digweed *et al.* 2003). No birch leafmining sawflies were detected at Hay River and Louise Falls, Northwest Territories (NT), in 1993, but the ambermarked birch leafminer, *Profenusa thomsoni* (Konow), was reported from Yellowknife, NT, in 1994 (Digweed *et al.* 1997). Since that time, *P. thomsoni* populations have reached epidemic levels on urban birches in Yellowknife and Hay River, NT (unpublished data). While examining infested birches in Hay River in 2003, the authors also found the European alder leafminer, *Fenusa dohrnii* (Tischbein), attacking alder (*Alnus* spp., Betulaceae). This leafminer occurs on a variety of alder species (Smith 1971, 1981), but its distribution and host preferences in northern Canada are unknown. This study was undertaken to establish: (*i*) the geographic limits of the urban infestations of birch leafmining sawflies in Yellowknife and Hay River and (*ii*) the geographic distributions of all species of leafmining sawflies on birch and alder in southern portions of NT and Yukon (YK).

Birch and alder along roadsides and in urban centres were examined for leafmining sawflies during 25–31 August (NT) and 8–13 September (YK) 2003. Species sought on birch included *P. thomsoni*, *Fenusa pusilla* (Lepeletier), and *Heterarthrus nemoratus* (Fallen), all of which occur in western Canada, and *Messa nana* (Klug) and *Scolioneura betuleti* (Klug), which have been recorded only in eastern Canada (Digweed *et al.* 1997). Surveys were conducted in late summer because at this time mines are large and obvious, allowing detection of rare species. Most birch surveyed were paper birch (*Betula papyrifera* Marsh.) or Alaska paper birch (*B. neoalaskana* Sarg.), but at some sites water birch (*B. occidentalis* Hook.), bog birch (*B. glandulosa* Michx.), and dwarf birch (*B. pumila* L.) were also examined. At each site, leaves in the lower crowns were visually searched for 2–5 min for mature mines. Leafminer species are described as rare if <5% of leaves were mined and abundant if >20% of leaves were mined. Alder species encountered were green (*Alnus viridis* subsp. *crispa* (Ait.) Turrill), Sitka (*A. viridis* subsp. *sinuata* (Regel) Á. *et* D. Löve), speckled (*A. incana* subsp. *rugosa* (Du Roi) Clausen), and mountain alder (*A. incana* subsp. *tenuifolia* (Nutt.) Breitung). We pooled observations of the latter two species because of difficulty distinguishing them, and possible hybrids, in the field.

The survey was structured to examine birch in most urban areas along major roads south of the 64th parallel. Roadside sites were also examined in the course of travel between urban sites. Roadside sites were selected based on the presence of birch, and any alder present were also examined. Where birch was continuous, sites were sampled every 20–40 km, but where birch was rare (*i.e.*, trees or stands more than 30 km apart), each birch stand encountered was surveyed. A greater density of sites was

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examined in urban areas where birch leafmining sawflies were abundant, to attempt to establish boundaries of infestations.

Profenusa thomsoni occurred widely across NT and YK (Fig. 1). It was abundant on many trees in the four largest urban areas: Yellowknife, Whitehorse, Hay River, and Ft. Smith. In smaller towns *P. thomsoni* was rare (Enterprise, Ft. Simpson, and Ft. Liard in NT, and Dawson City and Watson Lake in YK) or absent (Ft. Providence, Ft. Resolution, Edzo, and Rae in NT, and Carmacks, Haines Junction, Beaver Creek, and Teslin in YK).

Profenusa thomsoni was abundant in Yellowknife, with many birches having over 90% of leaves mined. This infestation extended 10–15 km into surrounding wild birch stands west of the city and discontinuously 60 km east of Yellowknife to Reid Lake. The northern and southern boundaries of this infestation extended beyond road access; *P. thomsoni* was present at Fred Henne Park on the northern boundary of the city and at the terminations of Kam Lake Road and Con Road on the southern boundary of the city.

Infestations in the other three large urban areas were heaviest in downtown areas and decreased towards town edges. Outside urban areas, *P. thomsoni* was rarely encountered in NT and then usually at sites frequently visited by humans, including roadside rest areas, day-use picnic areas, campgrounds, or isolated homes. This was true of sites sampled between Enterprise and Ft. Providence, sites east of Yellowknife, the Alexandra Falls site south of Enterprise, and the Polar Lake and Salt Mountain sites between Hay River and Ft. Smith (Fig. 1). No rural sites were found with *P. thomsoni* as abundant as seen on urban trees in Yellowknife, Hay River, and Ft. Smith. In YK, no *P. thomsoni* were encountered outside urban areas.

Fenusa pusilla and *H. nemoratus* were found only in urban areas in NT. *Fenusa pusilla* occurred on two trees in Hay River and was rare on both. *Heterarthrus nemoratus* occurred in both Yellowknife and Hay River and was the most prevalent leafmining sawfly on small birches at the Hay River beach on Great Slave Lake (up to approximately 50 mines per tree), where *P. thomsoni* was rare. Neither *M. nana* nor *S. betuleti* was found in NT or YK.

Fenusa dohrnii was widely distributed in NT but was not detected in YK (Fig. 2). It occurred at every site in NT where speckled and (or) mountain alder were found but never attacked green alder. Because alder is not planted as an ornamental, all sites where speckled and (or) mountain alder were found were rural. Similarly to other studies (*e.g.*, Hart *et al.* 1991), our study showed that *F. dohrnii* attacked only new foliage at branch tips. Our rearings from leaves collected on 8 August 2003 (63 larvae were placed in sterilized sand and peat moss from 10 to 16 August 2003 at outdoor ambient temperature in Edmonton, Alberta, and 15 adults emerged from 2 to 5 September 2003) suggest that this species is at least bivoltine, and possibly multivoltine, in NT, as it is in the eastern United States (Slingerland 1905; Hart *et al.* 1991). Our rearings of *P. thomsoni*, a strictly univoltine species (Digweed *et al.* 1997), at the same time and under identical conditions produced no adult sawflies in autumn 2003.

Of the three species of leafmining sawflies attacking birch in western Canada, only *P. thomsoni* is widespread in NT and YK, and it appears to have an anthropogenic distribution. We hypothesize that two human-centred modes of dispersal account for the distribution of *P. thomsoni* in NT and YK: (1) nursery trade distribution of infested trees among cities and large towns and (2) automobile transportation of gravid female sawflies from heavily infested urban birches to frequently visited roadside sites. The first mode of dispersal may explain how leafmining sawflies were first introduced into NT and YK; *P. thomsoni* must have been more abundant, or introduced more often, than *F. pusilla* or *H. nemoratus*. The second mode of dispersal is probable because these sawflies are clumsy fliers and often land on clothing or other objects placed near a birch tree (personal observation). It explains our finding *P. thomsoni* at parks and rest areas

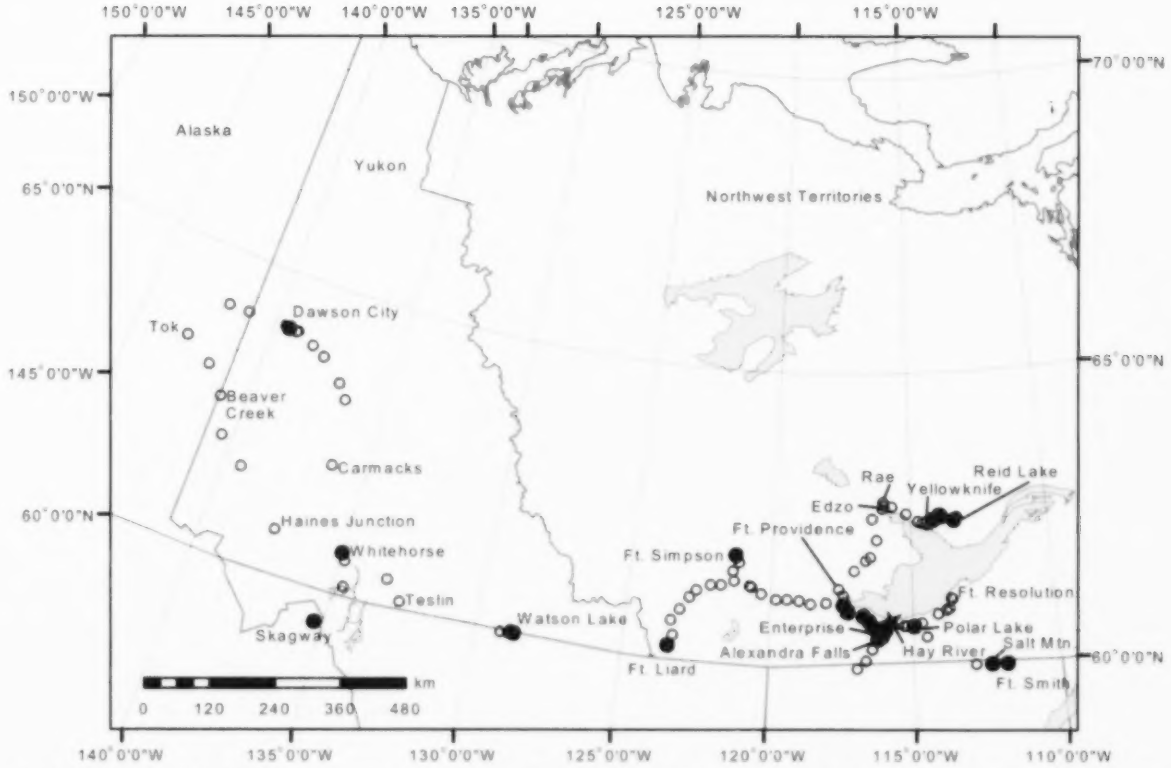

FIGURE 1. Distributions of the birch leafmining sawfly species *Fenusa pusilla*, *Heterarthrus nemoratus*, and *Profenusa thomsoni* in Northwest Territories and Yukon in 2003. ○, no birch leafmining sawflies found; ●, *P. thomsoni*; ⊗, *P. thomsoni* and *H. nemoratus*; ★, *P. thomsoni*, *H. nemoratus*, and *F. pusilla*.

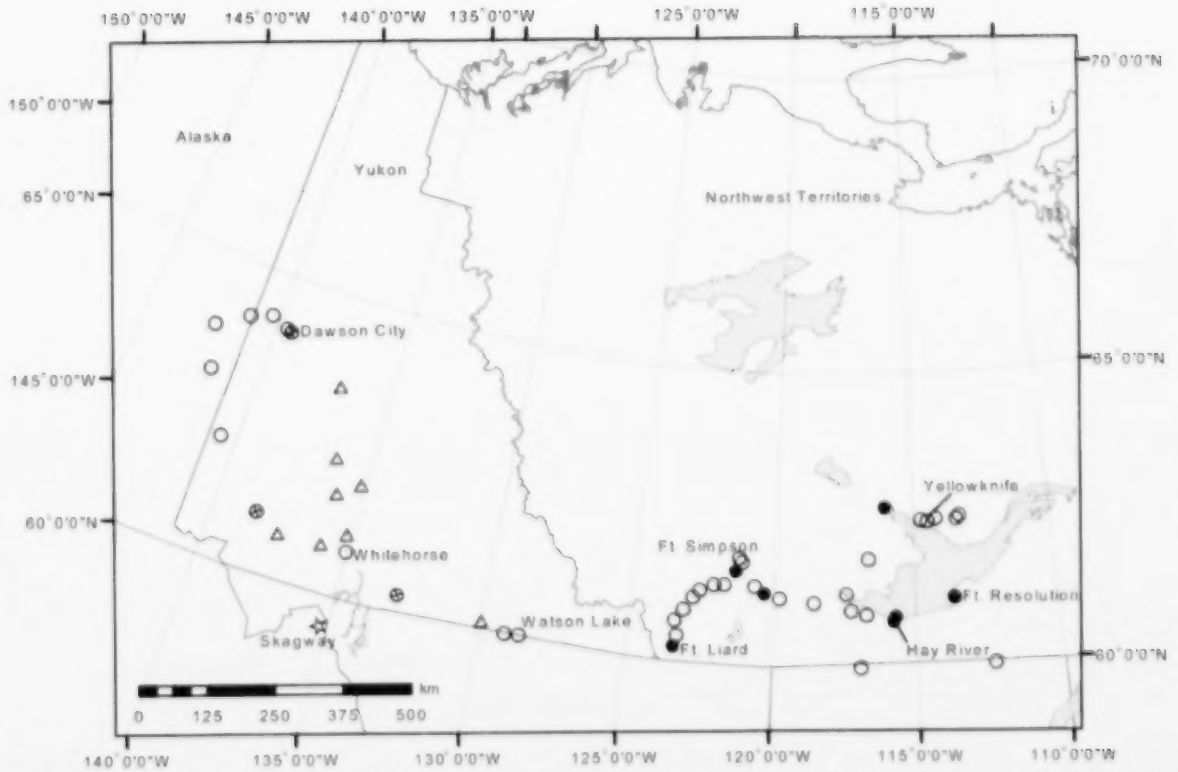

FIGURE 2. Distributions of the alder leafmining sawfly *Fenusa dohrnii* and of potential host alder species in Northwest Territories and Yukon in 2003. At all sites where *F. dohrnii* occurred, it mined speckled and (or) mountain alder (*Alnus incana* subsp. *rugosa* and (or) *A. incana* subsp. *tenuifolia*). ○, green alder (*A. viridis* subsp. *crispa*); △, speckled and (or) mountain alder; ⊗, green and speckled and (or) mountain alder; ☆, Sitka alder (*A. viridis* subsp. *sinuata*); ●, *F. dohrnii* mining in speckled and (or) mountain alder.

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within a short drive from Yellowknife, Hay River, and Ft. Smith, with no infestations in less visited sites nearby or in parks and rest areas further afield. *Fenusa pusilla* and *H. nemoratus* are probably too rare to accidentally "hitch a ride" out of urban areas.

The widespread and apparently non-anthropogenic distribution of *F. dohrnii* in NT suggests that this species has expanded its range effectively in North America largely unassisted by humans. Because alder is rarely planted as an ornamental, nursery trade distribution of infested trees probably contributed little to range expansion of *F. dohrnii*. The large modern geographic range of this species in North America (Smith 1971) implies that it may be anciently Holarctic, but it was first observed mostly on European alders at just a few locations in eastern North America in the early 1890s (Slingerland 1905), suggesting an anthropogenic origin in the Nearctic. We did not find this species in YK, suggesting that its range may still be expanding in northwestern Canada.

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Digweed SC, Spence JR, Langor DW. 1997. Exotic birch-leafmining sawflies (Hymenoptera: Tenthredinidae) in Alberta: distributions, seasonal activities, and the potential for competition. *The Canadian Entomologist* **129**: 319–33

Digweed SC, McQueen RL, Spence JR, Langor DW. 2003. *Biological control of the ambermarked birch leafminer,* Profenusa thomsoni *(Hymenoptera: Tenthredinidae), in Alberta*. Information Report NOR-X-389. Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, Alberta

Hart ER, Petty DG, Hall RB, Herms DA, Hanna RD, Kean JN. 1991. Activity of *Fenusa dohrnii* (Hymenoptera: Tenthredinidae) on *Alnus* in the northcentral United States. *Environmental Entomology* **20**: 534–9

Slingerland, MV. 1905. Two new shade-tree pests: sawfly leaf-miners on European elms and alder. *Bulletin — New York, Agricultural Experiment Station (Ithaca)* **233**: 49–62

Smith DR. 1971. Nearctic sawflies. III. Heterarthrinae: adults and larvae (Hymenoptera: Tenthredinidae). *US Department of Agriculture Technical Bulletin* **1420**

——— 1981. Studies on the leaf-mining sawflies of the tribe Fenusini in Asia (Hymenoptera: Tenthredinidae). *Proceedings of the Entomological Society of Washington* **83**: 763–71

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